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Competitiveness and Protection in World Agriculture

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The United States advocates competitive and efficient world markets. This report explores what agricultural competitiveness means by using three different measures: market share, relative export advantage, and revealed competitiveness. Each measure has a special use. This analysis shows that the most competitive agricultural exporters are usually those with the least government intervention. It also shows that the United States is most competitive in agricultural commodities such as soybeans and coarse grains that receive relatively little government protection. This apparent conflict between competitiveness and protection suggests that openness makes markets perform better, increasing global economic efficiency.

U.S. Competitive Ability Questioned

Farm exports were a small part of U.S. agriculture prior to the 1970's. Agricultural exports started to swell in 1968, increasing from \$6.5 billion to \$45.1 billion in 1981. As exports grew, so did belief that the United States would be the principal world supplier of staple food. But, U.S. agricultural exports sharply dropped in the 1980's, averaging \$30 billion in 1985-87 (fig. 1). This turnaround raised questions about the ability of the United States to compete in the world market for agricultural goods.

But, the record, revealed in this bulletin, shows that the United States is indeed competitive, especially in the least subsidized commodities, such as soybeans. We reach this conclusion by exploring three competitive measures—market share, relative export advantage, and revealed competitiveness—and then comparing the competitiveness indexes with levels of government intervention or protection which various countries wield in their agricultural economies. The results will clearly show the more competitive to be the least protected.

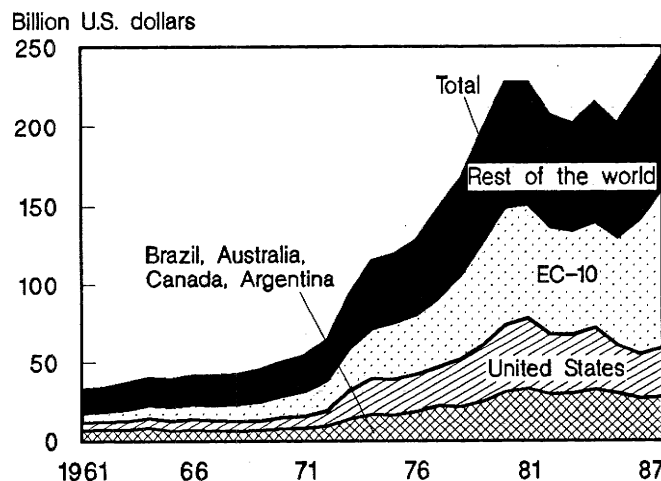
The Three Competitiveness Measures: When To Use Them

Market Share. A quick reference to a country's absolute share of a world commodity market.

Relative Export Advantage. A good measure when trying to gauge a country's competitiveness for a single commodity in the world market, in comparison with foreign exporters and other commodities produced.

Revealed Competitiveness. A better measure when trying to gauge a country's overall agricultural competitiveness. This statistic can also be applied to other economic sectors such as manufacturing.

Figure 1
Major players in agricultural exports



"Market Share" a Commonly Used Competitive Measure

The most commonly used indicator of competitiveness is market share—the percentage of the world market of a commodity held by an exporter. Shifts in commodity market share reflect how competitiveness has changed for like commodities imported by other countries. Changing U.S. patterns for wheat, coarse grains, rice, and soybeans between 1961-87 are shown in figure 2.

The United States captured a greater share of the world grain market in the early 1970's. U.S. market shares for wheat and coarse grains had declined in the 1960's, but suddenly increased in the early 1970's. The rice share continued to rise steadily. Increases in market shares in the early 1970's corresponded with sharp drops in the value of the U.S. dollar in the international market, especially in 1971-72 when the United States devalued its currency.

After the adoption of flexible exchange rates, the dollar continued losing value until 1979, making most U.S. goods more competitive in foreign markets. The United States was able to increase its market share for some commodities:

	<u>1970-71</u>	<u>1979-80</u>
	<i>Percent</i>	
Coarse grains	34.5	57.0
Wheat	31.2	38.3

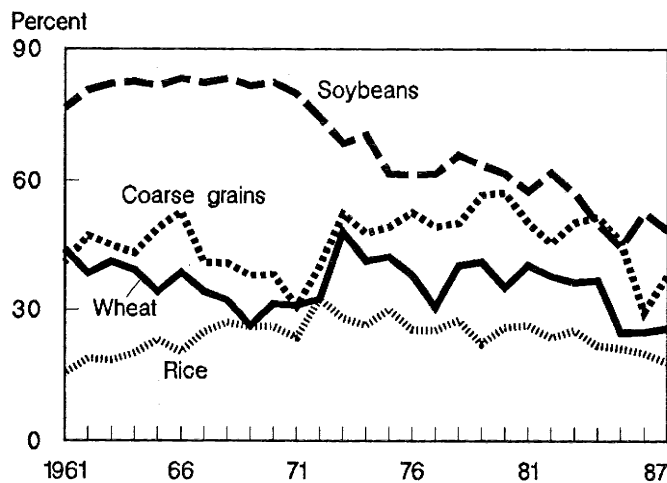
But, market shares for rice and soybeans declined. The loss in the soybean market was particularly dramatic: the U.S. share dropped from 81.2 percent in 1970-71 to 62.7 percent in 1979-80 as increased competition from Brazil and Argentina exceeded the positive effects of dollar devaluation.

The United States is generally better able to expand market share for agricultural commodities when the world economy and global trade are booming than when they are contracting. The U.S. agricultural sector responds to growth in world demand because of its abundant land resource base and efficient transportation infrastructure.

The United States lost market shares for wheat, coarse grains, rice, and soybeans in the 1980's as global economic conditions deteriorated. The world experienced a recession in 1981-82, and the value of

Figure 2

U.S. commodity market shares reflect changing global economic conditions



U.S. market shares typically expand when the world economy is booming and the foreign currency price of the dollar is low, such as in the early 1970's.

the U.S. dollar increased sharply relative to other currencies between 1980 and 1985. Growth in world trade and global prosperity stopped abruptly in the early 1980's and surpluses of agricultural products mounted. By 1987, the U.S. market share for rice was 17.9 percent, down over 6 percentage points since 1979-80. U.S. 1986 market share for coarse grains fell to half the 1979-80 level, before increasing in 1987. Wheat and soybeans also regained market shares in the mid-1980's. The United States started recapturing its lost market share for these commodities as the U.S. dollar declined and as strong export policies in the 1985 U.S. farm legislation became effective.

Simple comparisons of market shares do not always adequately describe ability to compete. For example, Saudi Arabia, a country not likely to have a competitive edge in agriculture, was the largest exporter of wheat in the Middle East in 1987 and competed effectively in several U.S. wheat markets in North Africa and Asia. Large government subsidies, not resource advantages, allowed Saudi Arabia to increase its market share. For the past 4 years, Saudi wheat producers have received five times the world price of wheat.

Other measures of competitiveness, while more complicated, tell us more about competitiveness than can the market share measure.

More Revealing Measures of Competitiveness

Basic economics holds that the producer with the lowest cost of production will be the most successful competitor. Such a competitor is said to have the best underlying "competitive advantage." But, it is often difficult to tell who has this true advantage in world markets today. The reason is that producer prices are often affected by forces beyond farmers' control, such as government policies that affect exchange rates. The continually changing value of currencies makes it difficult to compare costs of production between different countries.

Two additional measures based on the overall trade record can *reveal* more about a country's competitiveness than does the market share measure. These measures—*relative export advantage* and *revealed competitiveness*—can answer such questions as: How well does a country export one good, say soybeans, compared with all other goods? How does one country compare with another and the rest of the world?

The first way—relative export advantage—is based on an intermediate comparison of market shares of world trade. We first compare a country's market share of one specific exported item with the country's market share of all exported items to give us that country's *relative export share*. A further refinement—eliminating doublecounting of the country and commodities appearing in the equation—yields the relative export advantage measure reported in this bulletin.

These calculations are demonstrated in the accompanying box, "Method of Calculating Revealed Competitive Advantage Based on the Overall Trade Record." For example, the United States between 1982 and 1986 had a 53-percent share of world exports of soybeans. However, it has had only an 11-percent share of world exports of all goods. By comparison, therefore, we see that the United States is five times better at exporting soybeans than it is at exporting all the goods it exports. In this example, the relative export share of the United States in soybeans is 5. By itself, this number is not especially helpful. More examples are needed to see the value of the method.

Consider, therefore, coarse grains. Over the past decade, the United States has had a 45-percent share of world exports of coarse grains, compared once again with only an 11-percent share of world exports of all goods. The relative export share of the United States in coarse grains is 4. In this case, the export

record infers that the United States has a better underlying competitive advantage in soybeans than in coarse grains.

A refinement of the equation eliminates country and commodity doublecounting to give us a more precise competitiveness measure called the relative export advantage index. This index usually tells pretty much the same story, showing a relative export advantage index of 10 for soybeans and 7 for coarse grains. A further adjustment of these indexes to natural logarithms eases comparisons and is reflected in figure 3 (see equations in accompanying box).

The second way of looking at the basic questions about competitiveness—revealed competitiveness—summarizes how well a country's economic sector, such as agriculture, competes with other economic activity in the domestic and international markets. It accounts for both exports and imports by the country in question. This adjustment is made because countries have two-way trade in their economic sectors.

Relative Export Advantage: Who Has the Competitive Edge in Each Commodity?

The United States, Australia, and Canada, which had market shares of 40.4, 10.2, and 16.4 percent for wheat in 1981, all showed relative export advantages for wheat for the whole period analyzed (see positive values in fig. 3). By contrast, the EC-10, which had a large market share of 21.5 percent for wheat in 1981, had a relative export disadvantage for wheat in 1961-85 (see negative values in fig. 3), though it nearly had a relative export advantage in 1986 and 1987.

Among principal coarse grains suppliers, only the United States, with a 50.5-percent market share in 1981, and Argentina, with a 10.5-percent market share that same year, had positive relative export advantages for the whole period analyzed (fig. 3). Canada flip-flopped between positive and negative values during the period. With 5.1 percent of the market in 1981, Canada had relative export disadvantages for coarse grains in 1962-70, 1974, 1977, 1980, and 1984-85. The EC-10 had relative export disadvantages for coarse grains in every year but 1987, despite its comparatively high market share of 19 percent.

The United States, Thailand, Pakistan, and the EC-10 were the largest world rice exporters in 1981 with 26.4-, 21-, 9.8-, and 8.9-percent market shares. Among this group, the two developing countries (Thailand and Pakistan) had higher relative export ad-

vantage rankings than the developed areas, the United States and the EC-10 (fig. 3). Pakistan dramatically boosted its competitiveness for rice in the first half of the 1970's when the green revolution, in which farmers switched to high-yield seed varieties and adopted more modern cultivation practices, greatly increased output. The EC-10 had a relative export disadvantage for rice, although it is a major world supplier. This trend

matches the EC-10's revealed competitive disadvantages for other grains.

The United States still dominates the soybean market despite increasing foreign competition. The U.S. 1981 market share for soybeans was 57.6 percent, while market shares in Brazil, EC-10, and Argentina were 22.3, 10.6, and 5.1 percent. The United States ranked

Method of Calculating Revealed Competitive Advantage Based on the Overall Trade Record*

One way to judge competitiveness is to ask, "What does the overall trade record *reveal* about a country's performance?"

Suppose we want to know how competitive the United States is in soybeans. As noted in the text, we can first work out the formula for *relative export shares*, an intermediate step toward relative export advantage. What does the record show about our soybean trade performance?

$$\begin{array}{l} \text{U.S. relative} \\ \text{soybean} \\ \text{export} \\ \text{shares} \end{array} = \frac{\frac{\text{U.S. soybean exports}}{\text{World soybean exports}}}{\frac{\text{U.S. total exports}}{\text{World total exports}}} = \frac{\frac{\$6.80 \text{ bil.}}{\$12.70 \text{ bil.}}}{\frac{\$205.70 \text{ bil.}}{\$1,919.44 \text{ bil.}}} = \frac{.5354}{.1071} = 5.00$$

The record reveals that the United States was 5.00 times better at exporting soybeans than the average of all its exports, compared with the world.

The value of the method becomes more apparent when we compare relative export shares between various commodities. For instance, what does the record reveal about coarse grains? Is the United States more competitive at soybeans, or coarse grains?

$$\begin{array}{l} \text{U.S. relative} \\ \text{coarse} \\ \text{grains export} \\ \text{shares} \end{array} = \frac{\frac{\text{U.S. coarse grain exports}}{\text{World coarse grain exports}}}{\frac{\text{U.S. total exports}}{\text{World total exports}}} = \frac{\frac{\$6.37 \text{ bil.}}{\$13.99 \text{ bil.}}}{\frac{\$205.70 \text{ bil.}}{\$1,919.44 \text{ bil.}}} = \frac{.4553}{.1071} = 4.25$$

According to the above data, the United States has a better relative export share in soybeans (5.00) than in coarse grains (4.25).

Four market shares are used to arrive at *relative export advantage*. U.S. relative soybean export advantage is expressed this way:

$$\begin{array}{l} \text{U.S. relative} \\ \text{soybean} \\ \text{export} \\ \text{advantage} \end{array} = \frac{\frac{\text{U.S. soybean export share}}{\text{U.S. export share of all goods excluding soybeans}}}{\frac{\text{Foreign soybean export share}}{\text{Foreign export share of all goods excluding soybeans}}} = \frac{\frac{.5354 \text{ share}}{.1043 \text{ share}}}{\frac{.4638 \text{ share}}{.8957 \text{ share}}} = \frac{5.1329}{.5178} = 9.91$$

Relative export advantage makes clear distinctions between a specific commodity and all other commodities and between a specific country and the rest of the world. This refinement eliminates country and commodity doublecounting in world trade.

* See technical appendix for mathematical expressions for competitiveness statistics.

high in relative export advantage during 1961-87 (fig. 3).

However, Brazil and subsequently Argentina penetrated this market in the 1960's and 1970's, as shown by sharp increases in their relative export advantage indexes and corresponding declines in the U.S. indexes.

Relative export advantage indexes reveal an overall trend of sustained U.S. competitiveness for soybeans, wheat, and rice, despite declining U.S. market share for these major staples.

U.S. soybean producers, for example, are still competitive in the global market relative to other world producers and relative to producers of other U.S. com-

The record reveals that the United States was 9.91 times better at exporting soybeans than other things it exported, compared with all foreign countries. Again, we can compare soybeans with coarse grains. Is the United States more competitive at soybeans, or coarse grains? Let us see, using a nonshare definition of relative export advantage:

$$\begin{array}{l} \text{U.S. relative} \\ \text{coarse grains} \\ \text{export} \\ \text{advantage} \end{array} = \frac{\frac{\text{U.S. coarse grain exports}}{\text{U.S. exports excluding coarse grains}}}{\frac{\text{Foreign coarse grain exports}}{\text{Foreign exports excluding coarse grains}}} = \frac{\frac{\$6.37 \text{ bil.}}{\$199.33 \text{ bil.}}}{\frac{\$7.62 \text{ bil.}}{\$1,706.12 \text{ bil.}}} = \frac{.03194}{.00447} = 7.14$$

The United States has a better relative export advantage in soybeans (9.91) than in coarse grains (7.14), as the above data show.

In this report, a further adjustment to the method is made. The raw indexes (such as 9.91 and 7.14) are converted to natural logarithms:

$$\text{U.S. relative soybean export advantage} = \text{Ln} (9.91) = 2.29$$

and

$$\text{U.S. relative coarse grains export advantage} = \text{Ln} (7.14) = 1.92$$

These natural logs (soybeans, 2.29, and coarse grains, 1.92) allow easier comparisons between export advantages (which have a plus sign) and export disadvantages (which have a minus sign). These are the indexes we will see in the accompanying text and charts on relative export advantage.

To arrive at a final index number for *revealed competitiveness*, we subtract the relative import advantage of the sector from its relative export advantage. As in the relative export advantage index, we use natural logarithms to ease comparisons.

For example:

$$\begin{array}{l} \left(\begin{array}{l} \text{U.S. relative} \\ \text{export advantage} \\ \text{in agriculture} \end{array} \right) - \left(\begin{array}{l} \text{U.S. relative} \\ \text{import advantage} \\ \text{in agriculture} \end{array} \right) = 1.3 \\ \text{and} \\ \left(\begin{array}{l} \text{Other developed} \\ \text{countries relative} \\ \text{export advantage in} \\ \text{agriculture} \end{array} \right) - \left(\begin{array}{l} \text{Other developed} \\ \text{countries relative} \\ \text{import advantage} \\ \text{in agriculture} \end{array} \right) = -0.4 \end{array}$$

These formulas show that the United States has a revealed agricultural competitive advantage, but that the "other developed country" group has a revealed competitive disadvantage in agriculture (see fig. 5).

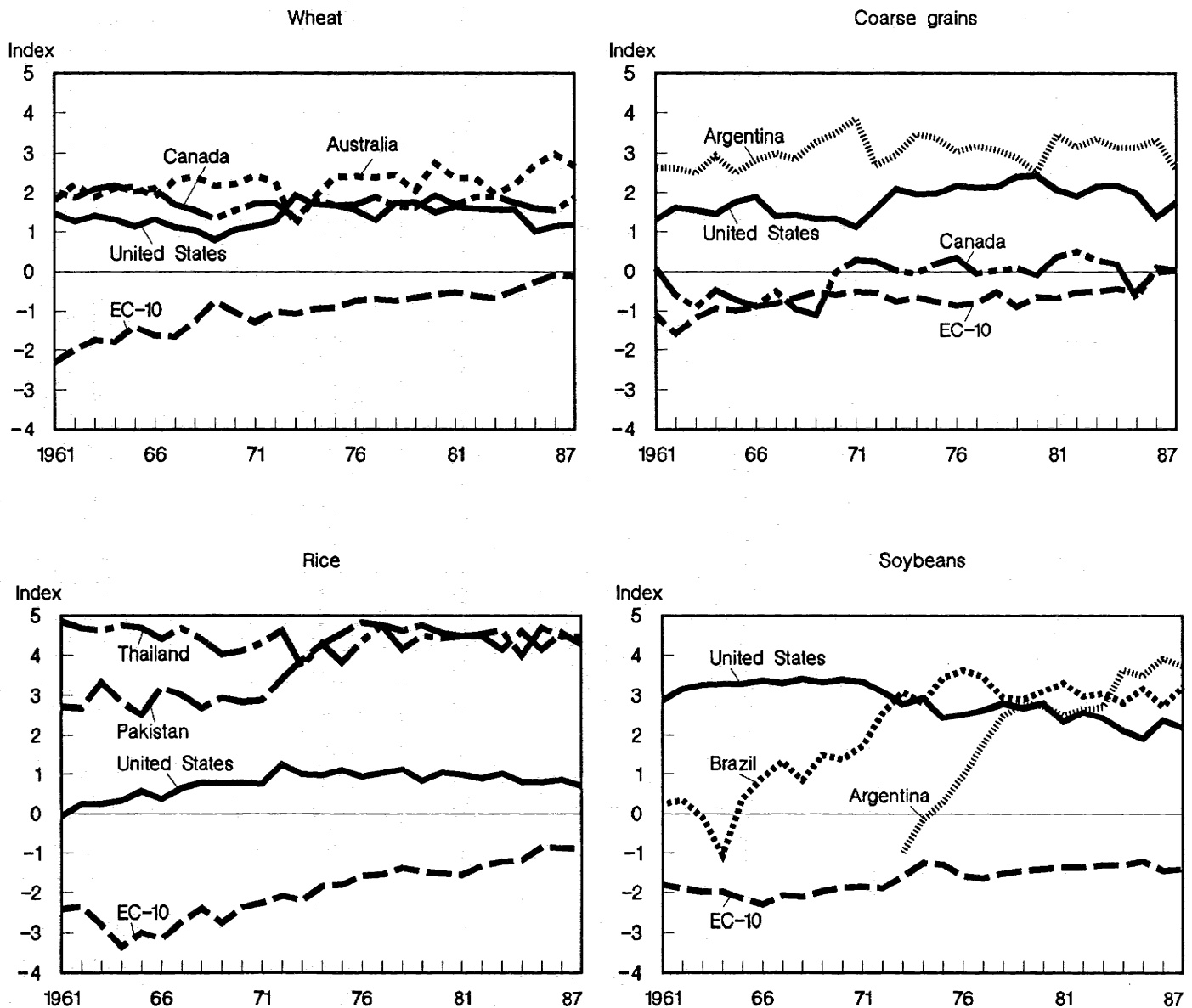
modity exports. Brazil and Argentina are gaining ground in soybean trade, though, as shown by sharp increases in their relative export advantage indexes for this commodity. In 1985, for example, Argentina had an index on soybeans of about 3, compared with the U.S. index of about 2. Thus, Argentina had a relative export advantage over the United States that year.

Revealed Competitiveness: The Best Performance Measure When Looking at All Agricultural Commodities

Revealed competitiveness is an index number measuring how well a country competes when all commodities in a sector such as agriculture are lumped together and both export and import advantages are assessed. The

Figure 3

Relative export advantage measures relative competitiveness among the following top world commodity traders



For all four commodities, the United States is competitive, while the EC-10 is not.

revealed competitiveness index summarizes many effects and countereffects into one number. That number compared with another country's number is a way to summarize a very complicated world trade picture.

The United States and other "high-income countries" show uptrends for revealed agricultural competitiveness, while "low- and middle-income countries" show downtrends (fig. 4). However, the longrun downward trend of low-income countries reversed itself in 1974, and, after a 3-year deterioration in 1978-80, began regaining strength until 1987.

The declining competitiveness among developing countries occurs as a result of their shrinking relative agricultural export supply and rising relative import demand for agricultural commodities. This finding matches the observation that developing countries are important future sources of import demand because domestic demand in developing countries is outstripping domestic supply. The opposite situation exists in the United States, where growth in relative agricultural import demand is falling while growth in relative agricultural export supply is rising. These demand and supply shifts suggest that developing countries will provide markets for U.S. agricultural products unless their ability to purchase imports is constrained.

The United States, compared with a mixed group of economies, has had the strongest revealed agricultural

competitiveness since 1973 (fig. 5). The U.S.S.R. and the developing countries lost agricultural competitiveness from the early 1960's to the late 1970's and then reversed trend. Eastern Europe shows a pattern of alternative positive and negative rankings on the revealed agricultural competitiveness scale, suggesting neutrality.

Most Competitive, Least Protected

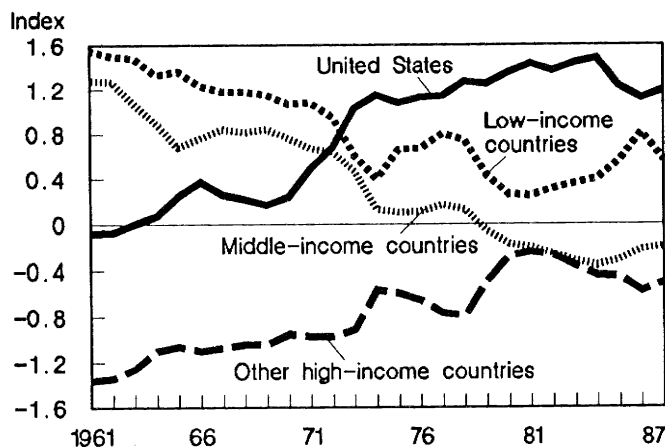
Relative export advantages and revealed competitiveness in agriculture show an underlying pattern: that the most competitive agricultural exporters are often the least protected. We use the relative export advantage index, the revealed competitiveness index, and the producer subsidy equivalent measure—the percentage of producer income provided by government assistance—to help uncover the kind of policies that foster competitiveness.

Protection in the form of government intervention may enhance competitiveness in the short run. Government support can help disadvantaged commodities cross the threshold to comparative advantage because it helps producers attract private capital investment. But prolonged protection may hurt a country's competitiveness as excess profits bid up prices of fixed assets and, hence, the costs of production.

Figure 6 shows how major agricultural exporters compare on competitiveness and protection for total agricul-

Figure 4

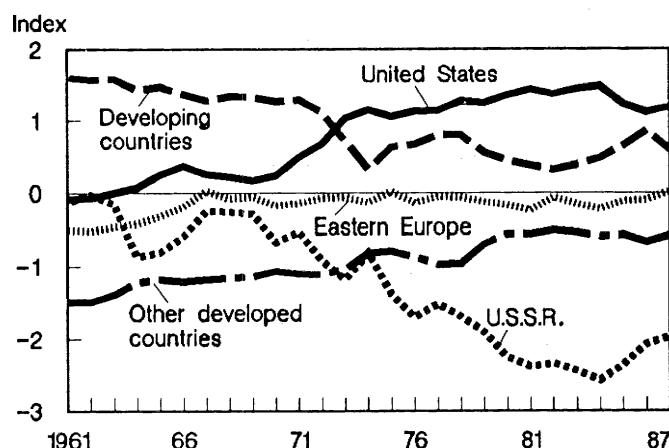
How the United States compares with other groups on revealed agricultural competitiveness



The revealed agricultural competitiveness measure takes into account both imports and exports. The United States shows strong competitiveness since 1973 when compared with other income country groups.

Figure 5

How the United States compares with selected countries on revealed agricultural competitiveness



Only the United States shows both positive and rising longrun relative competitiveness in agriculture in this comparison.

ture. The EC-10, the United States, Brazil, Australia, and Canada were used to compare revealed agricultural competitiveness and agricultural producer subsidy equivalents. These countries had 32.1, 19.8, 4.2, 4.1, and 3.4 percent of market share in 1981. The EC-10 has the highest level of government intervention, and it alone among the major agricultural exporters operates with a revealed competitive disadvantage in agriculture.

Countries suffer economic losses when resources are misallocated. An example is the EC-10. Although the EC-10's Common Agricultural Policy supports European agriculture and increased the market share of the EC-10's agricultural exports, it has not yet enabled the EC-10 to operate at a revealed competitive advantage in agriculture (fig. 6).

In developed countries, government intervention and competitiveness usually are inversely related. In the United States, for example, coarse grains and soybeans, the least protected, are the most competitive commodities, as the relative export advantage indexes in figure 7 indicate.

United States Has a Competitive Edge, Especially in Less Subsidized Commodities

The United States shows longrun competitive growth in agriculture relative to nonagriculture and relative

to the agricultural sectors in other countries. Expansion of world agricultural demand, a developed infrastructure, agricultural technology, and the ability of the U.S. farmer to compete for resources largely explain growth in U.S. agricultural competitiveness.

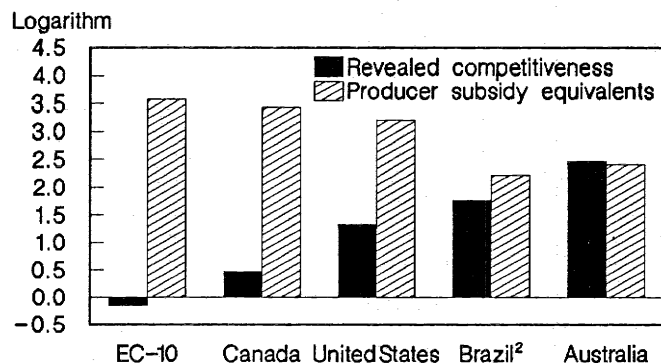
Increased agricultural competition confronts the United States. Major competitors in the developing world include Pakistan and Thailand for rice, Argentina for coarse grains, and both Brazil and Argentina for soybeans. The major competitor in the developed world, the EC-10, has been focusing resources on wheat, coarse grains, rice, and soybeans, despite operating at relative competitive disadvantages in these commodities.

The United States is most competitive in agricultural commodities receiving relatively little protection, such as soybeans and coarse grains. Negative relationships between competitiveness and protection in agriculture suggest that openness toward the global market promotes both longrun economic efficiency and competitiveness.

For More Information...

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Figure 6
How major exporters compare on competitiveness and government intervention for total agriculture¹

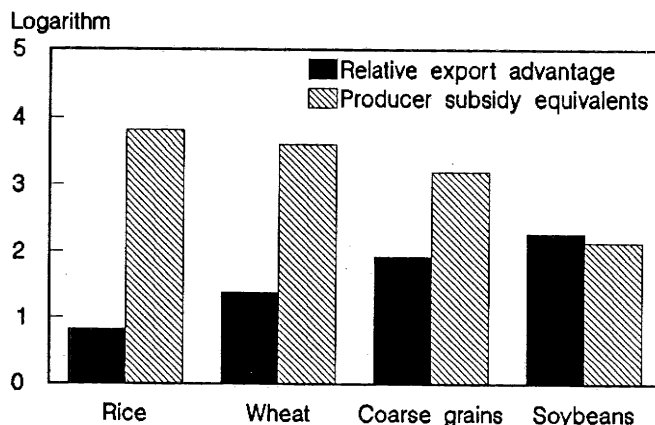


1/ Values denoted are 1982-86 averages.

2/ Most developing countries tax their agricultural sector to obtain resources for industrial development. This explains why Brazil's level of protection is not higher.

The EC-10, which has the highest level of agricultural protection among the major agricultural exporters, does not possess a competitive edge in agriculture.

Figure 7
In U.S. agriculture, the higher the level of government intervention, the lower the level of competitiveness¹



1/ Values denoted are 1982-86 averages.

The United States is most competitive in agricultural commodities, such as soybeans and coarse grains, receiving relatively little protection.

Additional Readings from ERS

For a basic explanation about producer subsidy equivalents and world farm trade, check *Subsidy Equivalents: Yardsticks of Government Intervention in Agriculture for the GATT* (AIB-558), by Carl Mabbs-Zeno and Arthur Dommen, January 1989. \$3. Call ERS-NASS toll free to order: 1-800-999-6779 (8:30-5:00 Eastern Time).

For more indepth discussions on competitiveness, check *World Agriculture Situation and Outlook*, WAS-54, March, 1989, containing the two articles "Indicators of Competitiveness" by Thomas L. Vollrath and "Competitiveness" by John C. Dunmore. \$5.50. Call ERS-NASS toll free to order: 1-800-999-6779 (8:30-5:00 Eastern Time).

Acknowledgments

The author appreciates the editorial assistance of Enid Hodes and William J. Hudson.

Technical Appendix

The author calculated competitive measures using the following formulas:

Market share (MS) is defined as:

$$MS_a^i = XS_a^i / XS_a^w$$

where XS refers to exports, subscript *a* to any particular agricultural commodity, and superscripts *i* and *w* to the home country and to the world, respectively. In this study, the world is based upon a data base consisting of 114 countries.

Relative export advantage (RXA) is defined as:

$$RXA_{a,n}^{i,r} = \ln \left[\frac{XS_a^i / XS_a^r}{XS_n^i / XS_n^r} \right]$$

where superscript *r* refers to the rest of the world and subscript *n* to a commodity composite aggregate, excluding *a*.

Revealed competitiveness (RC) is defined as:

$$RC_{a,n}^{i,r} = \ln \left[\frac{XS_a^i / XS_a^r}{XS_n^i / XS_n^r} \cdot \frac{MD_n^i / MD_n^r}{MD_a^i / MD_a^r} \right]$$

where *MD* refers to imports.

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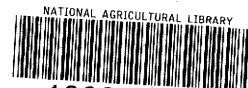
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